

**FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION**

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

SOUTHWEST DISTRICT • TAMPA BAY BASIN

## **Final TMDL Report**

# **Fecal Coliform TMDL for Bellows Lake Outlet (WBID 1579)**

**Rhonda Peets**



**November 2009**

## Acknowledgments

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## **Websites**

### ***Florida Department of Environmental Protection, Bureau of Watershed Restoration***

#### **TMDL Program**

<http://www.dep.state.fl.us/water/tmdl/index.htm>

#### **Identification of Impaired Surface Waters Rule**

<http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf>

#### **STORET Program**

<http://www.dep.state.fl.us/water/storet/index.htm>

#### **2008 305(b) Report**

[http://www.dep.state.fl.us/water/docs/2008\\_Integrated\\_Report.pdf](http://www.dep.state.fl.us/water/docs/2008_Integrated_Report.pdf)

#### **Criteria for Surface Water Quality Classifications**

<http://www.dep.state.fl.us/water/wqssp/classes.htm>

#### **Basin Status Report for the Tampa Bay Basin**

<http://www.dep.state.fl.us/water/basin411/tampa/status.htm>

#### **Basin Water Quality Assessment Report for the Tampa Bay Basin**

<http://www.dep.state.fl.us/water/basin411/tampa/assessment.htm>

### ***U.S. Environmental Protection Agency***

#### **Region 4: Total Maximum Daily Loads in Florida**

<http://www.epa.gov/region4/water/tmdl/florida/>

#### **National STORET Program**

<http://www.epa.gov/storet/>





# Chapter 1: INTRODUCTION

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## 1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform bacteria for Bellows Lake Outlet, in the Tampa Bay Basin. This waterbody was verified as impaired for fecal coliform and therefore was included on the Verified List of impaired waters for the Tampa Bay Basin that was adopted by Secretarial Order on June 3, 2008. The TMDL establishes the allowable fecal coliform loadings to Bellows Lake Outlet that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

## 1.2 Identification of Waterbody

Bellows Lake Outlet, locally known as East Bay Outlet, is located in Hillsborough County, about 4.5 miles inland north of McKay Bay (**Figure 1.1**). The outlet is a canal that drains an area of approximately 1.46 square miles. It originates from Bellows Lake, located in the watershed, covers a distance of 1 mile, and then connects to Six Mile Creek, which flows southwest into the Palm River and from there empties into McKay Bay. Several ponds and water retention areas throughout the Bellows Lake Outlet watershed are indirectly connected to the canal. These water areas, including the canal, appear to have no barriers; instead, they are open and accessible. The watershed is situated on the outskirts of the city of Tampa, outside the limits of any major city. Interstate (I-4) cuts directly through the watershed and pass over Bellows Outlet Canal. Additional information about the canal's hydrology and geology is available in the Basin Status Report for the Tampa Bay Basin (Florida Department of Environmental Protection [Department], 2001).

For assessment purposes, the Department has divided the Tampa Bay Basin into water assessment polygons with a unique **waterbody identification** (WBID) number for each watershed or stream reach. Bellows Lake Outlet is WBID 1579 (**Figure 1.2**).

## 1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program-related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida).

Figure 1.1. Location of the Bellows Lake Outlet Watershed (WBID 1579) in the Tampa Bay Basin and Major Geopolitical Features in the Area

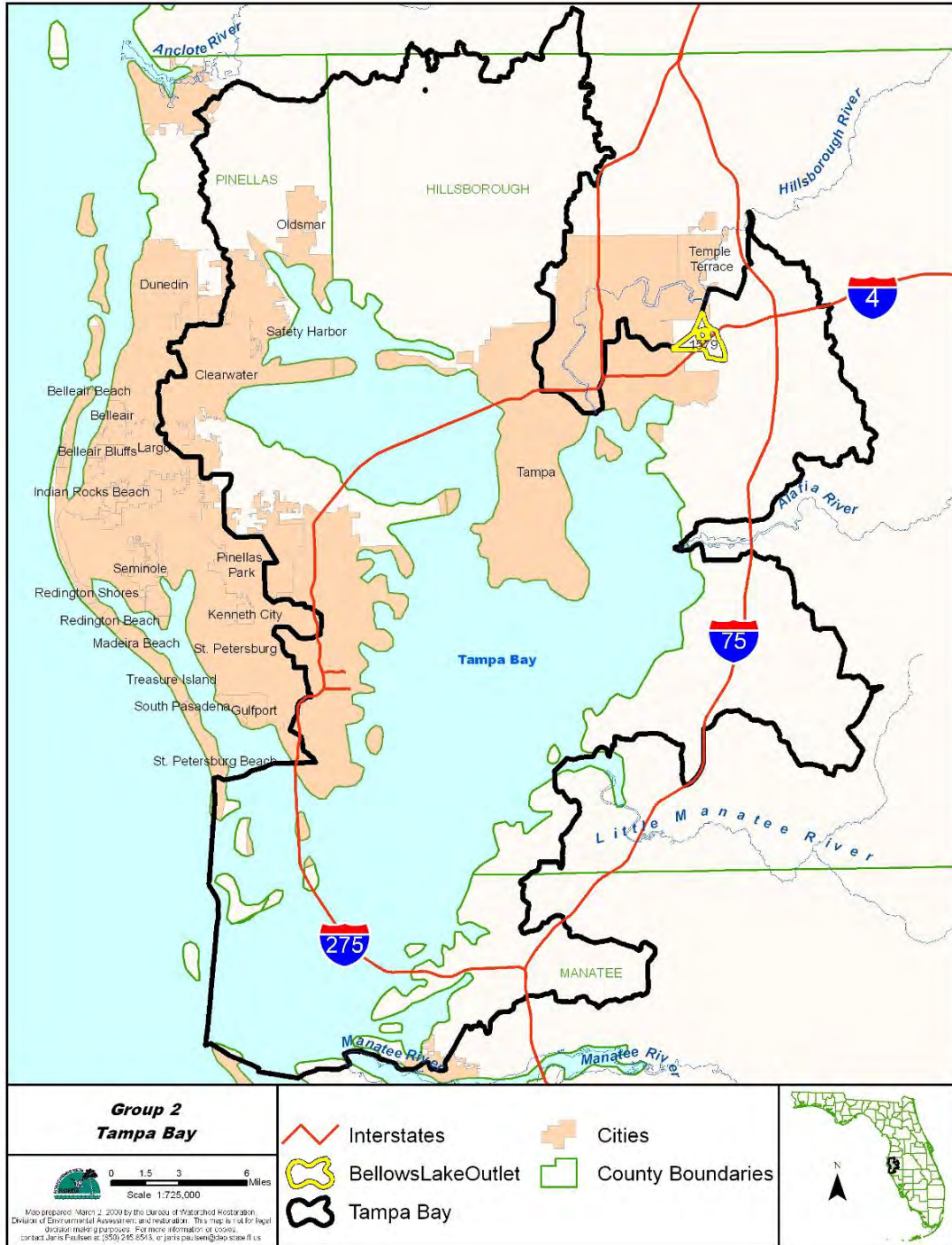
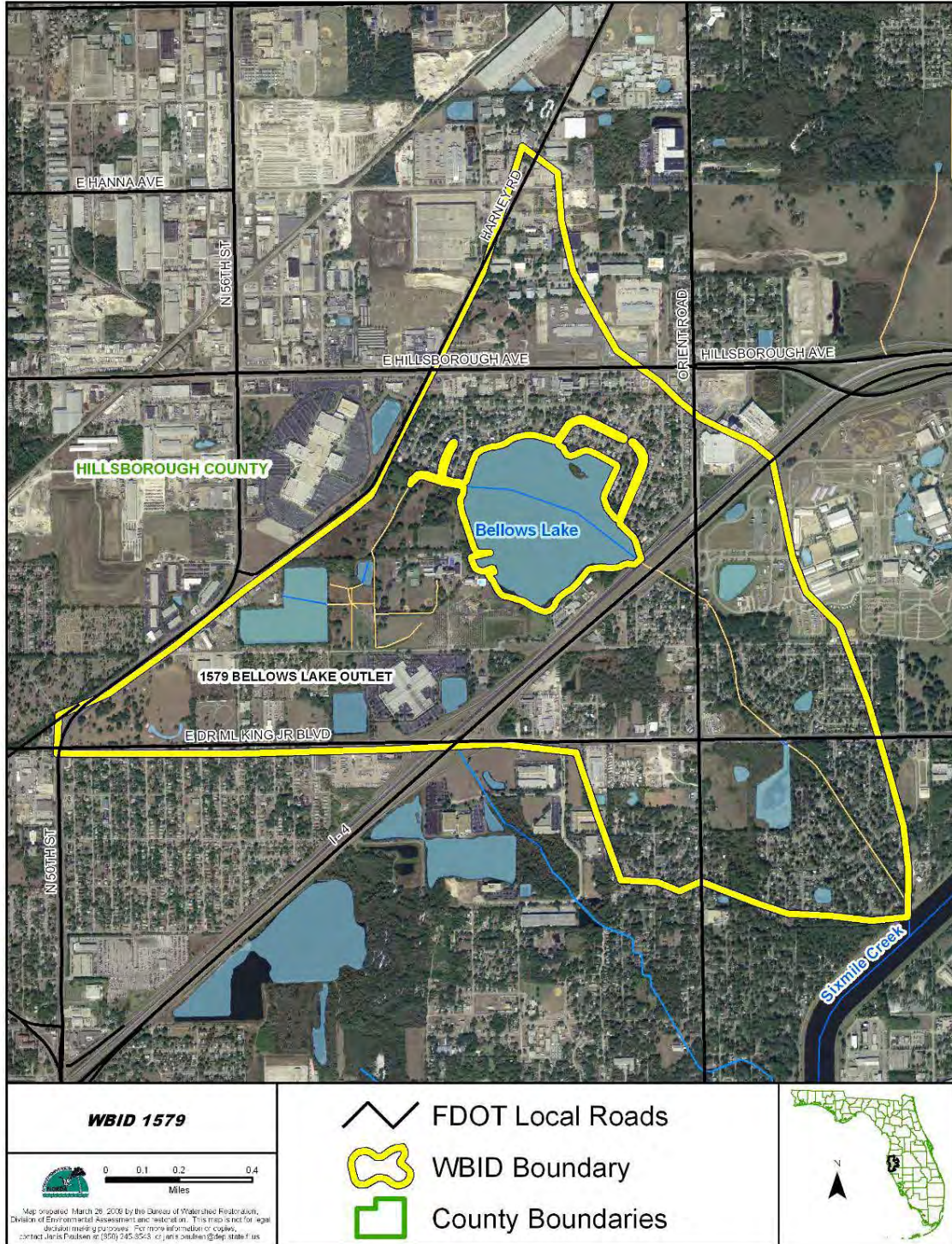


Figure 1.2. Location of the Bellows Lake Outlet Watershed (WBID 1579) in Hillsborough County



A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report may be followed by the development and implementation of a restoration plan designed to reduce the amount of fecal coliform that caused the verified impairment of Bellows Lake Outlet. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD), Hillsborough County Environmental Protection Commission (HEPC), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

## Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

### 2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]); the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 47 waterbodies in the Tampa Bay Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2006 and 2007.

### 2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Bellows Lake Outlet watershed and verified the impairment during the second cycle of the TMDL Program (**Table 2.1**). For the verified period (January 1, 2000, through June 30, 2007), data collected by the Department's Southwest District were excluded from the assessment, and additional data were collected outside the verified period. **Table 2.2** summarizes the fecal coliform data collected outside the verified period (November 2008 through December 2008). The projected year for the 1998 303(d)-listed fecal coliform bacteria TMDL for Bellows Lake Outlet was 2008, but the Settlement Agreement between the EPA and Earthjustice, which drives the TMDL development schedule for waters on the 1998 303(d) list, allows an additional nine months to complete the TMDLs. As such, these TMDLs must be adopted and submitted to the EPA by September 30, 2009.

Bellows Lake Outlet was verified as impaired based on fecal coliform because, using the IWR methodology, more than 10 percent of the values (11 out of 15 samples) exceeded the Class III freshwater stream criterion of 400 counts per 100 milliliters (counts/100mL) for fecal coliform. The fecal coliform data used in this report are based on the IWR Run34 database.

The verified impairment was based on data collected by Hillsborough County and the Department's Southwest District. **Figure 5.1** shows the WBID location and STORET stations. **Figure 2.1** displays the fecal coliform data collected from November 2008 through December 2008 for the watershed.

**Table 2.1. Verified Impairment for Bellows Lake Outlet (WBID 1579)**

\* IIIIF = Class III fresh water

\*\* WBID 1579 was included on the 1998 303(d) list for fecal coliform with a TMDL priority of low and due date of 2008.

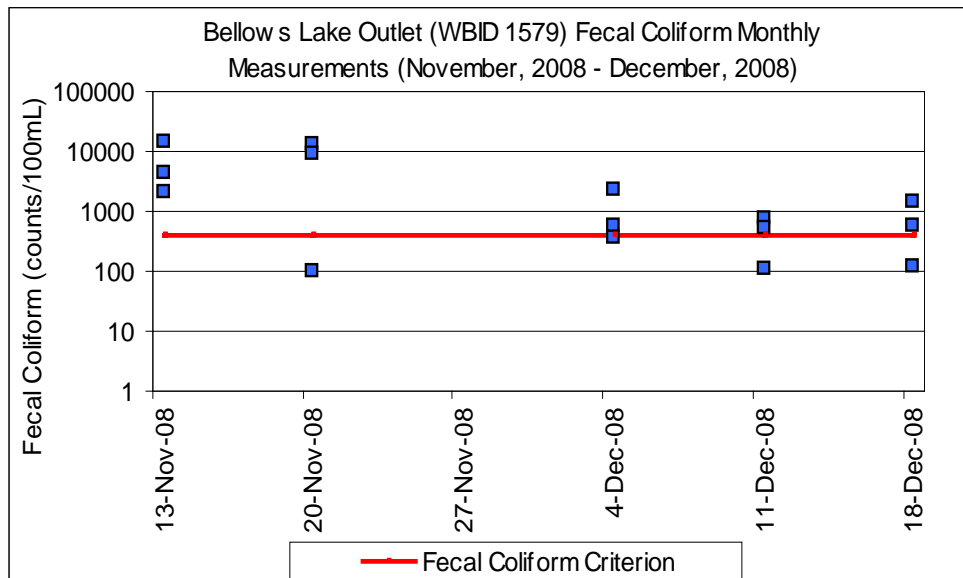
WBID	Waterbody Segment	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameter Causing Impairment
1579	Bellows Lake Outlet	Stream	IIIIF*	Coliform**	Fecal Coliform

**Table 2.2. Summary of Fecal Coliform Data for Bellows Lake Outlet (WBID 1579) During the Verified Period (January 1, 2000–June 30, 2007)**

\*Data were collected outside the verified period for assessment purposes.

WBID	Total Number of Samples	IWR-Required Number of Exceedances for the Verified List	Number of Observed Exceedances	Number of Observed Nonexceedances	Mean (#/100mL)	Median (#/100mL)	Minimum (#/100mL)	Maximum (#/100mL)
1579	15*	5	11	4	3,279	760	120	14,000

**Figure 2.1. Fecal Coliform Measurements for Bellows Lake Outlet (WBID 1579) (November 2008–December 2008)**



## Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

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### 3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

<b>Class I</b>	<b>Potable water supplies</b>
<b>Class II</b>	<b>Shellfish propagation or harvesting</b>
<b>Class III</b>	<b>Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife</b>
<b>Class IV</b>	<b>Agricultural water supplies</b>
<b>Class V</b>	<b>Navigation, utility, and industrial use (there are no state waters currently in this class)</b>

Bellows Lake Outlet is a Class III waterbody, with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The criterion applicable to this TMDL is the Class III criterion for fecal coliform.

### 3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentration. The water quality criterion for the protection of Class III waters, as established by Rule 62-302, F.A.C., states the following:

***Fecal Coliform Bacteria:***

*The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.*

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. During the development of the TMDL (as described in subsequent chapters), there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL was not to exceed 400 MPN/100mL in any sampling event for fecal coliform. The 10 percent exceedance allowed by the water quality criterion for fecal coliform bacteria was not used directly in estimating the target load, but was included in the TMDL's margin of safety (as described in subsequent chapters).

## Chapter 4: ASSESSMENT OF SOURCES

### 4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the impaired waterbody and the amount of pollutant loadings contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term “point sources” has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA’s National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources encompassed certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term “point source” will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **and** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

### 4.2 Potential Sources of Fecal Coliform in the Bellows Lake Outlet Watershed

#### 4.2.1 Point Sources

There are no NPDES-permitted facilities discharging fecal coliform bacteria directly or indirectly into Bellows Lake Outlet.

#### Municipal Separate Storm Sewer System Permittees

The stormwater collection systems owned and operated by Hillsborough County and co-permittee (Florida Department of Transportation [FDOT] District 7) are covered by a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000006). There are no Phase II MS4 permits identified for the Bellows Lake Outlet watershed.

#### 4.2.2 Land Uses and Nonpoint Sources

Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. Nonpoint pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made



pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water (EPA, 1994). Potential nonpoint sources of coliform include loadings from surface runoff, wildlife, livestock, pets, leaking sewer lines, and leaking septic tanks. **Table 4.5** provides a summary of the estimated fecal coliform loadings from dogs, septic tanks, and sanitary sewer overflows (SSOs) in the Bellows Lake Outlet watershed.

### Wildlife

Wildlife deposit coliform bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby streams. Some wildlife (such as otters, beavers, raccoons, and birds) deposits their feces directly into the water. The bacterial load from naturally occurring wildlife is assumed to be background. In addition, any strategy employed to control this source would probably have a negligible impact on attaining water quality standards.

### Agricultural Animals

Agricultural animals are the source of several types of coliform loading to streams. Agricultural activities, including runoff from pastureland and cattle in streams, can affect water quality. Agricultural land occupies 7.6 percent of the Bellows Lake Outlet watershed. **Table 4.1** lists 2002 livestock data for Hillsborough County (U.S. Department of Agriculture, 2002).

**Table 4.1. Livestock Distribution for Hillsborough County in 2002**

\*(D) – Data withheld to avoid disclosing data for individual farms.

Source: U.S. Department of Agriculture, 2002

Livestock Distribution	Hillsborough County (number of livestock)
Cattle/Calves	65,501
Milk Cows	4,408
Beef Cows	33,144
Hogs/Pigs	1,724
Poultry Layers > 20 weeks	(D)*
Poultry Broilers	428
Sheep/Lambs	793
Horses and Ponies	4,975

### Land Uses

The spatial distribution and acreage of different land use categories were identified using the SWFWMD's 2006 land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library. Land use categories in the watershed were aggregated using the simplified Level 1 codes and tabulated in **Table 4.2**. **Figure 4.1** shows the acreage of the principal land uses in the watershed.

As shown in **Table 4.2**, the entire Bellows Lake Outlet watershed drains approximately 1,275 acres of land. The dominant land use category is urban and built-up (approximately 40 percent), followed by high-density residential (24 percent) and medium-density residential (4.7 percent). There are no low-density residential areas in the watershed. The high-density residential areas surround Bellows Lake, which is located in the center of the watershed, and align with the canal that flows out of the lake. Agriculture and rangeland make up about 8

percent of the land use acreage, and the transportation, communication, and utilities category is about 6.8 percent.

**Table 4.2. Classification of Land Use Categories for the Bellows Outlet Watershed (WBID 1579) in 2006**

- = Empty cell/no data

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and Built-Up	505	39.6%
1100	Low-Density Residential	0	0.0%
1200	Medium-Density Residential	60	4.7%
1300	High-Density Residential	306	24.0%
2000	Agriculture	97	7.6%
3000	Rangeland	5	0.4%
4000	Forest/Rural Open	27	2.1%
5000	Water	156	12.2%
6000	Wetlands	32	2.5%
7000	Barrenland	0	0.0%
8000	Transportation, Communication, and Utilities	87	6.8%
-	<b>Total:</b>	<b>1,275</b>	<b>100.0%</b>

### Urban Development

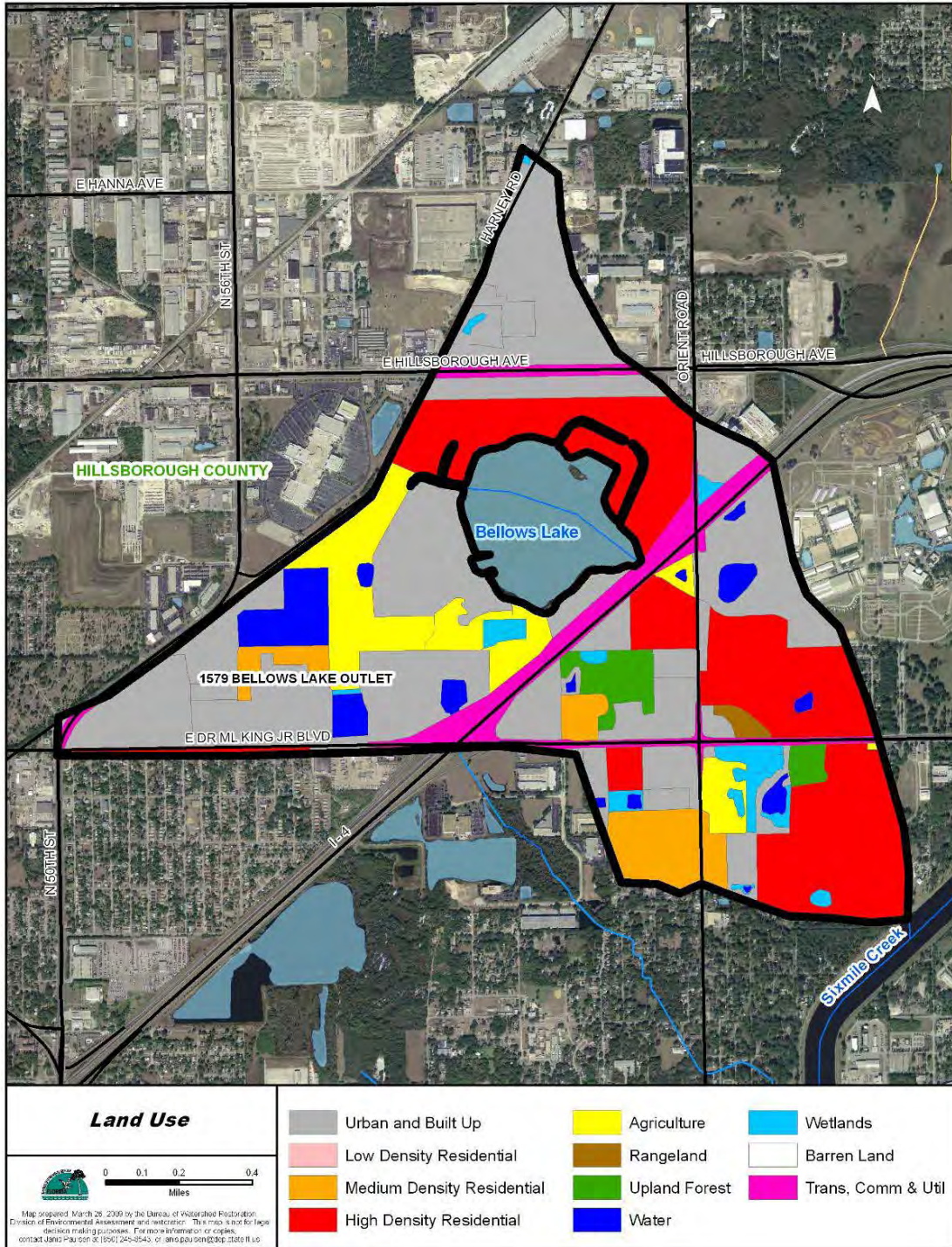
Pets (especially dogs) could be a significant source of coliform pollution through surface runoff in the Bellows Lake Outlet watershed. In addition to pets, other animal fecal coliform contributors commonly seen in urban areas include rats, pigeons, and sometimes raccoons.

Studies report that up to 95 percent of the fecal coliform found in urban stormwater can come from nonhuman origins (Alderiso et al., 1996; Trial et al., 1993). The most important nonhuman fecal coliform contributors appear to be dogs and cats. In a highly urbanized Baltimore catchment, Lim and Olivieri (1982) found that dog feces were the single greatest source for fecal coliform and fecal streptococcus bacteria. Trial et al. (1993) also reported that cats and dogs were the primary source of fecal coliform in urban watersheds. Using bacteria source tracking techniques, Watson (2002) found that the amount of fecal coliform bacteria contributed by dogs in Stevenson Creek in Clearwater, Florida, was as important as that from septic tanks.

According to the American Pet Products Manufacturers Association (APPMA), about 4 out of 10 U.S. households include at least 1 dog. A single gram of dog feces contains about 23 million fecal coliform bacteria (Van der Wel, 1995). Unfortunately, statistics show that about 40 percent of American dog owners do not pick up their dogs' feces.

**Table 4.3** shows the fecal coliform concentrations of surface runoff measured in two urban areas (Bannerman et al., 1993; Steuer et al., 1997). While bacteria levels were widely different in the two studies, both indicated that residential lawns, driveways, and streets were the major source areas for bacteria.

Figure 4.1. Principal Land Uses in the Bellows Lake Outlet Watershed (WBID 1579) in 2006



**Table 4.3. Concentrations (Geometric Mean Colonies/100mL) of Fecal Coliform from Urban Source Areas (Steuer et al., 1997; Bannerman et al., 1993)**

Geographic Location	Marquette, MI	Madison, WI
Number of storms sampled	12	9
Commercial parking lot	4,200	1,758
High-traffic street	1,900	9,627
Medium-traffic street	2,400	56,554
Low-traffic street	280	92,061
Commercial rooftop	30	1,117
Residential rooftop	2,200	294
Residential driveway	1,900	34,294
Residential lawns	4,700	42,093
Basin outlet	10,200	175,106

The number of dogs in the Bellows Lake Outlet watershed is not known. Therefore, this analysis used the statistics produced by APPMA to estimate the possible fecal coliform loads contributed by dogs. The human population in the watershed calculated from the census track using Tiger Track 2000 data (the Department's GIS library) were approximately 1,796. According to the U.S. Census Bureau, there were 2.50 people per household in Hillsborough County in 2007. This results in an estimated 718 households in the Bellows Lake Outlet watershed. Assuming that 40 percent of the households in this area have 1 dog, the total number of dogs in the watershed is about 287.

According to the waste production rate for dogs and the fecal coliform counts per gram of dog waste listed in **Table 4.4**, and assuming that 40 percent of dog owners do not pick up dog feces, the total waste produced by dogs and left on the land surface of residential areas is 51,660 grams/day. The total fecal coliform produced by dogs in the Bellows Lake Outlet watershed is  $1.14 \times 10^{11}$  counts/day.

It should be noted that this load only represents the estimated fecal coliform load created in the watershed and is not intended to be used to represent a part of the existing load that reaches the receiving waterbody. The fecal coliform load that eventually reaches the receiving waterbody could be significantly less than this value due to attenuation in overland transport.

**Table 4.4. Dog Population Density, Wasteload, and Fecal Coliform Density**

\* Number from APPMA.

Source: Weiskel et al., 1996.

Type	Population density (animal/household)	Wasteload (g/animal-day)	Fecal coliform density (fecal coliform/gram)
Dog	0.4*	450	2,200,000

## Septic Tanks

Septic tanks are another potentially important source of coliform pollution in urban watersheds. When properly installed, most of the coliform from septic tanks should be removed within 50 meters of the drainage field (Minnesota Pollution Control Agency, 1999). However, in areas with a relatively high ground water table, the drainage field can be flooded during the rainy season, and coliform bacteria can pollute the surface water through storm runoff. Septic tanks

may also cause coliform pollution when they are built too close to irrigation wells. Any well that is installed in the surficial aquifer system will cause a drawdown. If the septic tank system is built too close to the well (e.g., less than 75 feet), the septic tank discharge will be within the cone of influence of the well. As a result, septic tank effluent may go into the well and once the polluted water is used to irrigate lawns, coliform bacteria may reach the land surface and wash into surface waters during rainy periods.

A rough estimate of fecal coliform loads from failed septic tanks in each watershed can be made using **Equation 4.1**:

$$L = 37.85 * N * Q * C * F \quad \text{(Equation 4.1)}$$

Where:

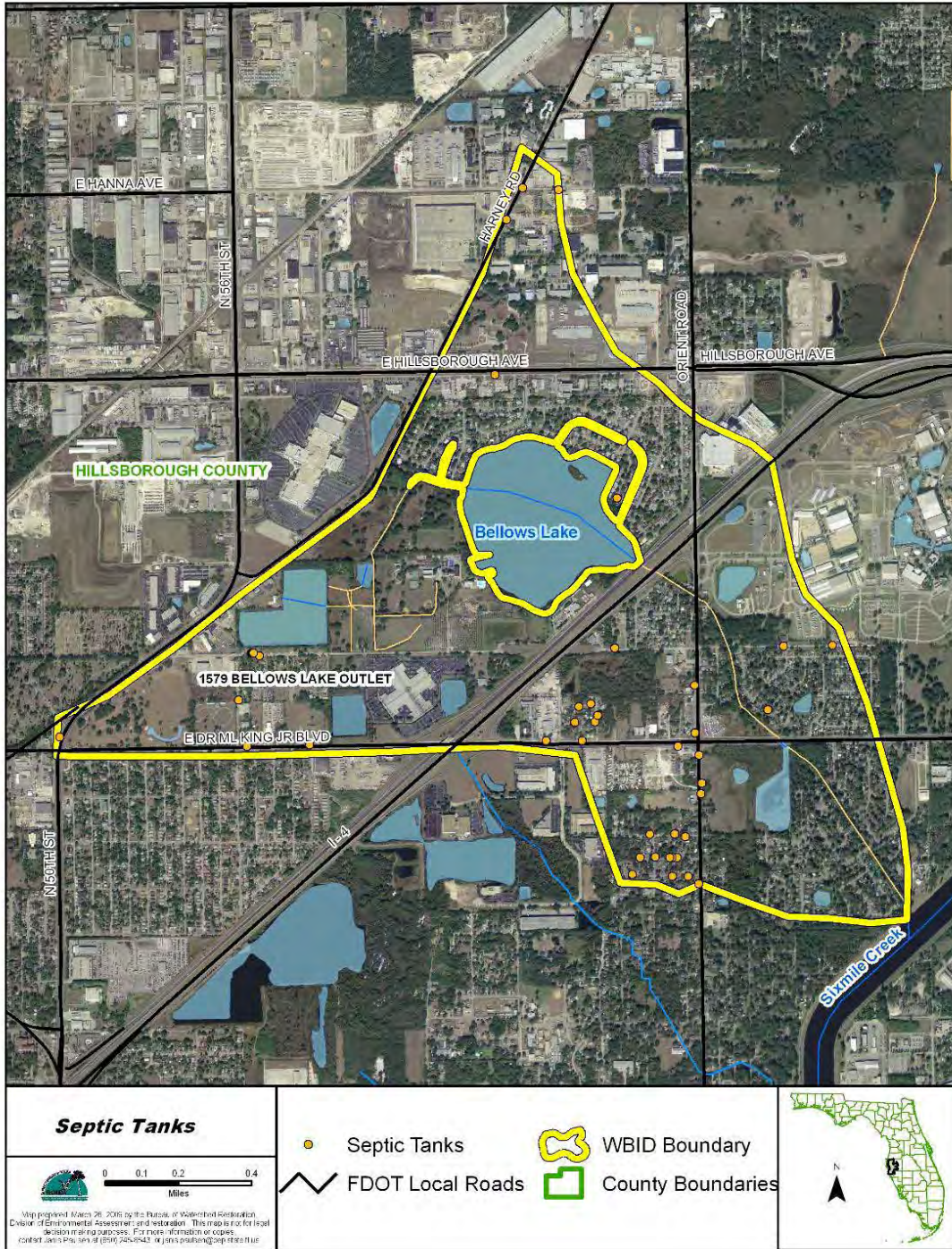
*L* is the fecal coliform daily load (counts/day);  
*N* is the total number of septic tanks in the watershed (septic tanks);  
*Q* is the discharge rate for each septic tank;  
*C* is the fecal coliform concentration for the septic tank discharge; and  
*F* is the septic tank failure rate.

Based on 2007 Florida Department of Health (FDOH) onsite sewage GIS coverage (available: <http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm>), about 61 housing units (*N*) were identified as being on septic tanks in the Bellows Lake Outlet watershed (**Figure 4.2**). The discharge rate from each septic tank (*Q*) was calculated by multiplying the average household size by the per capita wastewater production rate per day. Based on the information published by the U.S. Census Bureau, the average household size for Hillsborough County is about 2.50 people/household. The same population density was assumed for the Bellows Lake Outlet watershed. A commonly cited value for per capita wastewater production rate is 70 gallons/day/person (EPA, 2001). The commonly cited concentration (*C*) for septic tank discharge is  $1 \times 10^6$  counts/100mL for fecal coliform (EPA, 2001).

No measured septic tank failure rate data were available for the watershed when this TMDL analysis was conducted. Therefore the failure rate was derived from the number of septic tank and septic tank repair permits for Hillsborough County published by FDOH (available: <http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm>). The number of septic tanks in the county was calculated assuming that none of the installed septic tanks will be removed after being installed. The reported number of septic tank repair permits was also obtained from the FDOH Website.

Based on this information, a discovery rate of failed septic tanks for each year between 2002 and 2007 was calculated and listed in **Table 4.5**. Using the table, the average annual septic tank failure discovery rate for Hillsborough County is about 0.81 percent. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 4.1 percent. Based on **Equation 4.1**, the estimated fecal coliform loadings from failed septic tanks in the Bellows Lake Outlet watershed is  $1.67 \times 10^{10}$  counts/day.

Figure 4.2. Distribution of Onsite Sewage Systems (Septic Tanks) in the Bellows Lake Outlet Watershed (WBID 1579)



**Table 4.5. Estimated Septic Numbers and Septic Failure Rates for Hillsborough County, 2002–07**

- = Empty cell/no data

\* The failure rate is 5 times the failure discovery rate.

	2002	2003	2004	2005	2006	2007	Average
New installations (septic tanks)	986	1031	1005	1314	1236	487	1010
Accumulated installations (septic tanks)	99,483	100,469	101,500	102,505	103,819	105,055	102,139
Repair permits (septic tanks)	998	929	735	815	751	754	830
Failure discovery rate (%)	1.00%	0.92%	0.72%	0.80%	0.72%	0.72%	0.81%
Failure rate (%)*	5.0%	4.6%	3.6%	4.0%	3.6%	3.6%	4.1%

### Sanitary Sewer Overflows

SSOs can also be a potential source of fecal bacteria pollution. Human sewage can be introduced into surface waters even when storm and sanitary sewers are separated. Leaks and overflows are common in many older sanitary sewers where capacity is exceeded, high rates of infiltration and inflow occur (i.e., outside water gets into pipes, reducing capacity), frequent blockages occur, or sewers are simply falling apart due to poor joints or pipe materials. Power failures at pumping stations are also a common cause of SSOs. The greatest risk of an SSO occurs during storm events; however, few comprehensive data are available to quantify SSO frequency and bacteria loads in most watersheds.

Fecal coliform loading from sewer line leakage can be calculated, based on the number of people in the watershed, typical per household generation rates, and the typical fecal coliform concentration in domestic sewage, assuming a leakage rate of 0.5 percent (Culver et al., 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs in the Bellows Lake Outlet watershed can be made using **Equation 4.2**:

$$L = 37.85 * N * Q * C * F \quad \text{(Equation 4.2)}$$

Where:

- L* is the fecal coliform daily load (counts/day);
- N* is the number of households using sanitary sewer in the watershed;
- Q* is the discharge rate for each household;
- C* is the fecal coliform concentration for the domestic wastewater discharge; and
- F* is the sewer line leakage rate.

The number of households (*N*) in the Bellows Lake Outlet watershed that use sewer lines is 657 (total households minus septic tank households). The discharge rate through the sewer line from each household (*Q*) was calculated by multiplying the average household size (2.50 people) by the per capita wastewater production rate per day (70 gallons). The commonly cited concentration (*C*) for domestic wastewater is  $1 \times 10^6$  counts/100mL for fecal coliform (EPA, 2001). Of the total number of households using the sewer line, 0.5 percent (*F*) was assumed as the sewer line leakage rate (Culver et al., 2002). Based on **Equation 4.2**, the estimated fecal coliform loading from sewer line leakage in the Bellows Lake Outlet watershed is  $2.18 \times 10^{10}$  counts/day.

**Source Summary**

**Table 4.6** summarizes the estimated fecal coliform loadings from dogs, septic tanks, and SSOs in the watershed.

**Table 4.6. Estimated Fecal Coliform Loadings from Dogs, Septic Tanks, and SSOs in the Bellows Lake Outlet Watershed (WBID 1579)**

<b>Waterbody</b>	<b>Dogs (counts/day)</b>	<b>Septic Tanks (counts/day)</b>	<b>SSOs (counts/day)</b>
Bellows Lake Outlet (WBID 1579)	1.14 x 10 <sup>11</sup>	1.67 x 10 <sup>10</sup>	2.18 x 10 <sup>10</sup>



## Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

### 5.1 Determination of Loading Capacity

The fecal coliform TMDL calculation was developed using the "percent reduction" approach. For this method, the percent reduction needed to meet the applicable criterion is calculated for each value above the criterion, and then a median percent reduction is calculated.

#### 5.1.1 Data Used in the Determination of the TMDL

Fecal coliform concentration and flow measurements were used to estimate both the allowable and existing coliform loads. **Figure 5.1** shows the locations of the water quality sites where fecal coliform data were collected, and **Figure 5.2** shows fecal coliform measurements by station. **Figure 2.1** displays the data for fecal coliform used in the analysis. Data used for this TMDL report were mainly provided by the Department's Southwest District for Bellows Lake Outlet from Stations: 21FLTPA 27591538222229, 21FLTPA 2758546822297, and 21FLTPA 27583848221553.

#### 5.1.2 TMDL Development Process for Bellows Lake Outlet

As described in **Section 5.1**, the percent reduction needed to meet the fecal coliform criterion was determined for each individual exceedance using **Equation 5.1**:

$$\frac{[\text{measured exceedance} - \text{criterion}] * 100}{\text{measured exceedance}} \quad (\text{Equation 5.1})$$

The fecal coliform TMDL for Bellows Lake Outlet was calculated as the median of the percent reductions needed over the data range where exceedances occurred (see **Table 5.1** for data). As noted in the next section, exceedances occurred throughout the data period for Bellows Lake Outlet, and the median percent reduction for this period was 80 percent.

Figure 5.1. Locations of Water Quality Stations in Bellows Lake Outlet (WBID 1579)

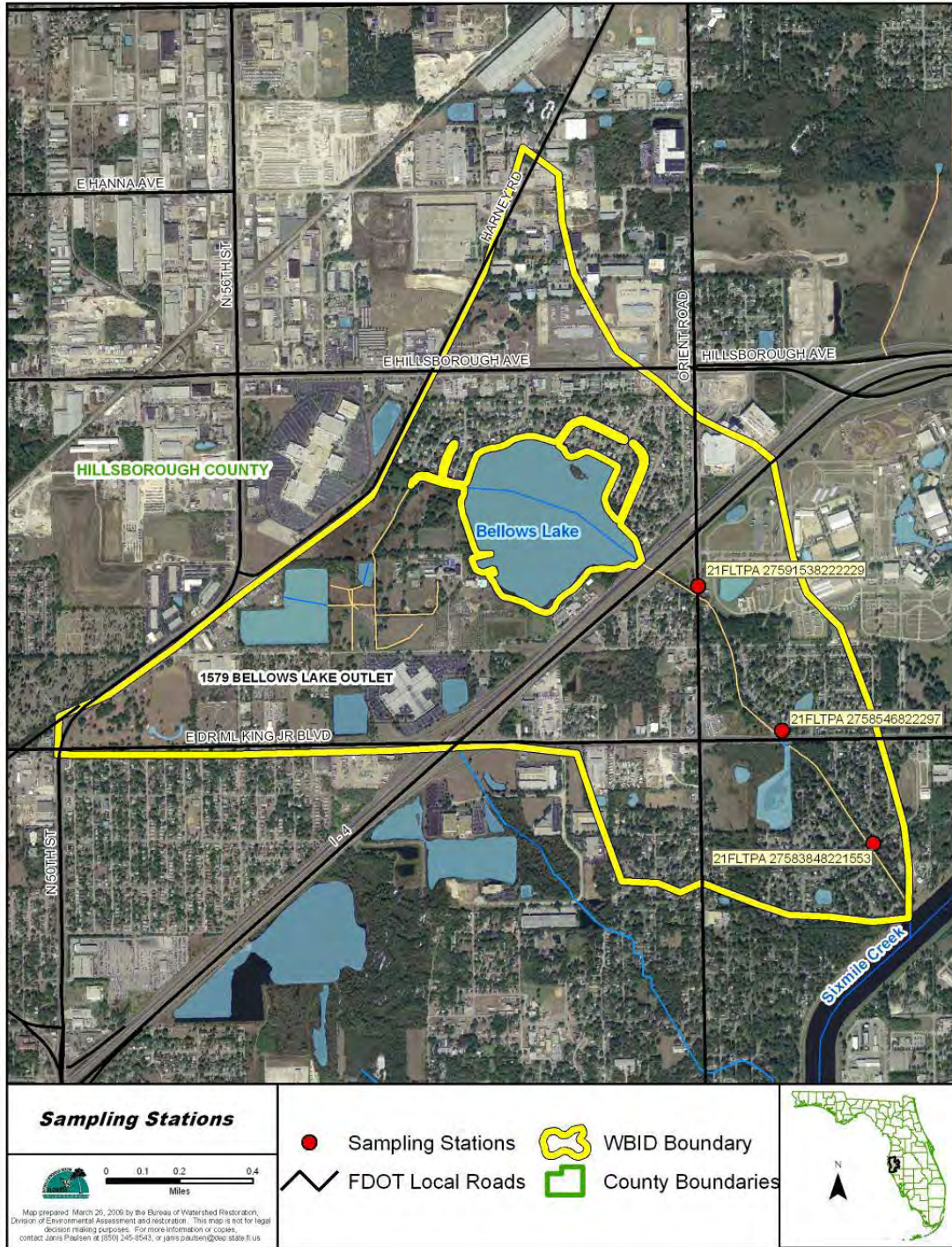
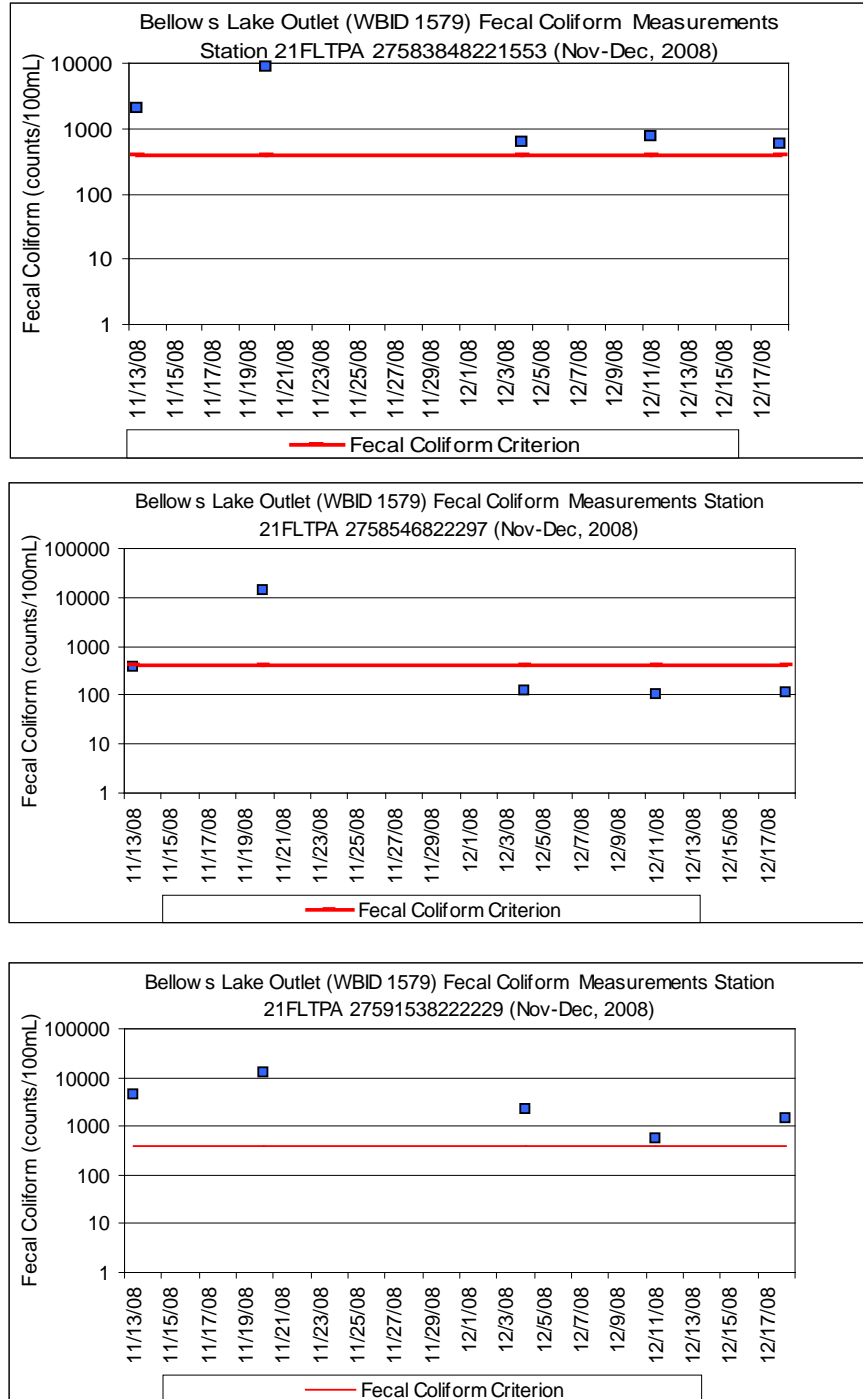


Figure 5.2. Fecal Coliform Measurements by Station for Bellows Lake Outlet (WBID 1579)



**Table 5.1. Calculation of Percent Reduction in Fecal Coliform Necessary to Meet the Water Quality Standard of 400 Colonies/100mL in Bellows Lake Outlet (WBID 1579)**

- = Empty cell/no data

<sup>1</sup> Data collected outside the verified period

Date <sup>1</sup>	Station	Fecal Coliform Exceedances (#/100mL)	Fecal Coliform Target (#/100mL)	% Reduction
12/4/2008	21FLTPA 27591538222229	540	400	25.9%
11/13/2008	21FLTPA 27583848221553	580	400	31.0%
12/18/2008	21FLTPA 27583848221553	600	400	33.3%
12/4/2008	21FLTPA 27583848221553	760	400	47.4%
12/18/2008	21FLTPA 27591538222229	1,500	400	73.3%
11/20/2008	21FLTPA 27583848221553	2,000	400	80.0%
11/20/2008	21FLTPA 27591538222229	2,300	400	82.6%
11/13/2008	21FLTPA 27591538222229	4,300	400	90.7%
12/11/2008	21FLTPA 27583848221553	8,900	400	95.5%
12/11/2008	21FLTPA 27591538222229	13,000	400	96.9%
12/11/2008	21FLTPA 2758546822297	14,000	400	97.1%
-	-	-	<b>MEDIAN:</b>	80.0%

### 5.1.3 Critical Conditions/Seasonality

The critical conditions for coliform loadings in a given watershed depend on the existence of point sources and land use patterns in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period, followed by a rainfall runoff event. During wet weather periods, coliform bacteria that have built up on the land surface under dry weather conditions are washed off by rainfall, resulting in wet weather exceedances. However, significant nonpoint source contributions could also occur under dry weather conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and coliform bacteria are brought into the receiving waters through baseflow. Livestock with direct access to the receiving water could also contribute to the exceedances during dry weather conditions. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

For Bellows Lake Outlet, the samples were limited, and therefore the Department was not able to determine any pattern in critical conditions and seasonality (see **Table 5.2**). The data were collected only over a two-month period (November and December 2008).

**Table 5.2. Summary Statistics of Fecal Coliform Data for Bellows Lake Outlet (WBID1579)**

Month	Number of Cases	Minimum (#/100mL)	Maximum (#/100mL)	Median (#/100mL)	Mean (#/100mL)	Number of Exceedances	% Exceedances of Cases
November (2008')	6	100	4,300	1,290	1,608	4	67%
December (2008')	9	120	14,000	760	4,392	7	78%

#### 5.1.4 Spatial Patterns

In the Bellows Lake Outlet watershed, monitoring for bacteria is conducted at three stations in the canal. Of the 5 samples taken in Station 21FLTPA 27583848221553 (**Table 5.3**), all exceeded the criterion of 400 counts/100mL; this station is the farthest downstream in the canal and is located in a high-density residential area (**Figure 5.4**). For Station 21FLT PA 2758546822297, located in the central portion of the canal, there was only 1 exceedance of 14,000 counts/100mL; this station is located in an area where there is a mixture of rangeland and small waterbodies (**Figure 5.1**). The upstream station, 21FLTPA 27591538222229, which had all exceedances for the 5 samples taken, is located in a high-density residential area mixed with agriculture. There is no information available on any special event (septic tank or sewer leakage) that may have triggered the high fecal coliform values in the watershed. Spatially, the stations closer to high-density residential areas had the most exceedances.

**Table 5.3. Station Summary Statistics of Fecal Coliform Data for Bellows Lake Outlet (WBID 1579)**

WBID	Station	# of Samples	Mean (#/100mL)	Minimum (#/100mL)	Maximum (#/100mL)
1579	21FLTPA 27591538222229	5	4,328	540	13,000
1579	21FLTPA 2758546822297	5	2,940	100	14,000
1579	21FLTPA 27583848221553	5	2,568	580	8,900

## Chapter 6: DETERMINATION OF THE TMDL

### 6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\text{TMDL} \cong \sum \text{WLAs}_{\text{wastewater}} + \sum \text{WLAs}_{\text{NPDES Stormwater}} + \sum \text{LAs} + \text{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for Bellows Lake Outlet is expressed in terms of counts/day and percent reduction. It represents the maximum daily fecal coliform loads the stream can assimilate and maintain the fecal coliform criterion (**Table 6.1**).

**Table 6.1. TMDL Components for Fecal Coliform in Bellows Lake Outlet (WBID 1579)**

N/A = Not applicable

\*Fecal coliform criterion (Subsection 62-302.530[6], Class III)

WBID	Parameter	TMDL (counts/day)	WLA for Wastewater (counts/day)	WLA for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
1579	Fecal Coliform	400 #/100mL*	N/A	80%	80%	Implicit

## 6.2 Load Allocation

Fecal coliform reductions of 80 percent for Bellows Lake Outlet are needed from nonpoint sources. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A**).

## 6.3 Wasteload Allocation

### 6.3.1 NPDES Wastewater Discharges

No NPDES-permitted wastewater facilities with fecal coliform limits were identified in the Bellows Lake Outlet watershed. The state already requires all NPDES point source dischargers to meet bacteria criteria at the end of the pipe. It is the Department's current practice not to allow mixing zones for bacteria. Any point sources that may discharge in the watershed in the future will also be required to meet end-of-pipe standards for coliform bacteria.

### 6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is an 80 percent reduction in current fecal coliform for Bellows Lake Outlet. It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

## 6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL by meeting the water quality criterion of 400 colonies/100mL, while the actual criterion allows for a 10 percent exceedance over that level.

## Chapter 7: TMDL IMPLEMENTATION

### 7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the Department will determine the best course of action regarding its implementation. Depending on the pollutant(s) causing the waterbody impairment and the significance of the waterbody, the Department will select the best course of action leading to the development of a plan to restore the waterbody. Often this will be accomplished cooperatively with stakeholders by creating a Basin Management Action Plan, referred to as the BMAP. BMAPs are the primary mechanism through which TMDLs are implemented in Florida (see Subsection 403.067[7], F.S.). A single BMAP may provide the conceptual plan for the restoration of one or many impaired waterbodies.

If the Department determines that a BMAP is needed to support the implementation of this TMDL, a BMAP will be developed through a transparent, stakeholder-driven process intended to result in a plan that is cost-effective, technically feasible, and meets the restoration needs of the applicable waterbodies. Once adopted by order of the Department Secretary, BMAPs are enforceable through wastewater and municipal stormwater permits for point sources and through BMP implementation for nonpoint sources. Among other components, BMAPs typically include the following:

- *Water quality goals (based directly on the TMDL);*
- *Refined source identification;*
- *Load reduction requirements for stakeholders (quantitative detailed allocations, if technically feasible);*
- *A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach;*
- *A description of further research, data collection, or source identification needed in order to achieve the TMDL;*
- *Timetables for implementation;*
- *Implementation funding mechanisms;*
- *An evaluation of future increases in pollutant loading due to population growth;*
- *Implementation milestones, project tracking, water quality monitoring, and adaptive management procedures; and*
- *Stakeholder statements of commitment (typically a local government resolution).*

BMAPs are updated through annual meetings and may be officially revised every five years. Completed BMAPs in the state have improved communication and cooperation among local stakeholders and state agencies; improved internal communication within local governments; applied high-quality science and local information in managing water resources; clarified the obligations of wastewater point source, MS4, and non-MS4 stakeholders in TMDL implementation; enhanced transparency in the Department's decision making; and built strong relationships between the Department and local stakeholders that have benefited other program areas.



## 7.2 Other TMDL Implementation Tools

However, in some basins, and for some parameters, particularly those with fecal coliform impairments, the development of a BMAP using the process described above will not be the most efficient way to restore a waterbody, such that it meets its designated uses. This is because fecal coliform impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Addressing these problems requires good old-fashioned detective work that is best done by those in the area.

A multitude of assessment tools is available to assist local governments and interested stakeholders in this detective work. The tools range from the simple (such as Walk the WBIDs and GIS mapping) to the complex (such as bacteria source tracking). Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize fecal coliform sources of pollution. Based on work in the Lower St Johns River tributaries and the Hillsborough Basin, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work. In the near future, the Department will be releasing these tools to assist local stakeholders with the development of local implementation plans to address fecal coliform impairments. In such cases, the Department will rely on these local initiatives as a more cost-effective and simplified approach to identify the actions needed to put in place a road map for restoration activities, while still meeting the requirements of Subsection 403.067(7), F.S.

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## Appendices

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### Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the state's water management districts to establish stormwater Pollutant Load Reduction Goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, they have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES Stormwater Program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and the master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the FDOT throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Stormwater Program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focus on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.



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